

**AMENDMENTS TO THE CLAIMS**

1. (CURRENTLY AMENDED) An apparatus for creating a pattern on a workpiece sensitive to light radiation, ~~such as a photomask a display panel or a microoptical device,~~ comprising
- a source for emitting light in the wavelength range from EUV to IR,
  - a spatial light modulator (SLM) having a multitude of modulating elements (pixels), adapted to being illuminated by said radiation
  - a projection system creating an image of the modulator on the workpiece,
  - an electronic data processing and delivery system receiving a digital description of the pattern to be written, converting said pattern to modulator signals, and feeding said signals to the modulator,
  - a precision mechanical system for positioning at least one of said workpiece and/or said projection system relative to each other,
  - an electronic control system controlling the position of the workpiece, the feeding of the signals to the modulator and the intensity of the radiation, so that said pattern is printed on the workpiece,
  - where the drive signals and the modulating elements are adapted to create a number of modulation states larger than two ~~and preferably larger than three.~~

2. (CURRENTLY AMENDED)     An The apparatus according to claim 1, where a modulating element modulates at least one of the following properties of the radiation:

- intensity
- phase
- complex amplitude
- direction
- ~~polarisation~~ polarization
- wavefront flatness
- frequency

where the modulation impressed on the radiation field has at least three, and preferably at least four, different states.

3. (CURRENTLY AMENDED)     An The apparatus according to claim 2, having a filter selective to the state of the radiation, thereby translating the modulation across the surface of the spatial modulator to an intensity image at the workpiece.

4. (CURRENTLY AMENDED)     An The apparatus according to claim 1, where a compensating ~~linearisation~~ linearization function is used in the conversion from the

input pattern description to the modulator voltages to correct for a non-linear response from the modulator voltages to the exposure on the workpiece.

5. (CURRENTLY AMENDED)     An The apparatus according to claim 4, where the linearization function is based on a theoretical simulation.
6. (CURRENTLY AMENDED)     An The apparatus according to claim 4, where the linearization function is based on an empirical ~~characterisation~~ characterization of the response.
7. (CURRENTLY AMENDED)     An The apparatus according to claim 4, where said response is the physical or chemical result of the exposure of a surface element, ~~such as the light absorption of a developed silver halide emulsion,~~ or the removal of material mass per surface area by an ablation process.
8. (CURRENTLY AMENDED)     An The apparatus according to claim 4, where the desired responses are computed as digital values and the ~~linearisation~~ linearization function is stored in a look-up table generating new corrected digital values used for generation of the modulator drive voltages.

9. (CURRENTLY AMENDED) An The apparatus according to claim 8, where the modulator voltages are created by digital analog converters.

10. (CURRENTLY AMENDED) An The apparatus according to claim 4, where the desired responses are computed as digital values and the values are used to select for each modulating element one of several ~~independently~~ independently generated voltages, and where said voltages are set to contain the ~~linearisation~~ linearization function.

11. (CURRENTLY AMENDED) An The apparatus according to claim 1, where at least two modulator voltage signals are fed to a single modulator element and the modulator element is responsive to the combination of the signals, thereby being driven to a larger number of states than the number of possible voltage values in each signal, ~~e.g. four binary signals creating sixteen different states of the modulating element.~~

12. (CURRENTLY AMENDED) An The apparatus according to claim 1, with a look-up table with corrections for different response between modulator elements.

13. (CURRENTLY AMENDED) An The apparatus according to claim 12, where the look-up table is generated during a calibration procedure where the response function of at least two different modulator elements are measured.

14. (CURRENTLY AMENDED)      An The apparatus according to claim 12, where said look-up table ~~storing~~ stores at least one of the following types of data for a modulating element:

- An offset voltage
- A sensitivity factor
- A polynomial response function.

15. (CURRENTLY AMENDED)      An The apparatus according to claim 12, where the correction of a modulating element is applied as a digital operation on a digital representation of the desired state of the modulator element.

16. (CURRENTLY AMENDED)      An The apparatus according to claim 12, where the correction of a modulating element is applied by an analog operation on the analog drive signal.

17. (CURRENTLY AMENDED)      An The apparatus according to claim 1, where the spatial modulator is a two-dimensional array of modulating elements with time-multiplexed loading of the values to the modulating elements and storage of the loaded value at each element.

18. (CURRENTLY AMENDED)     An The apparatus according to claim 1,  
where the modulator is built on a matrix-addressed active circuit.
19. (CURRENTLY AMENDED)     An The apparatus according to claim 1,  
where the modulator is built on top of a semiconductor chip.
20. (CURRENTLY AMENDED)     An The apparatus according to claim 1,  
where the modulator contains a ~~liquid~~ liquid crystal.
21. (CURRENTLY AMENDED)     An The apparatus according to claim 1,  
where the modulator has a viscoelastic layer.
22. (CURRENTLY AMENDED)     An The apparatus according to claim 1,  
where the modulator has an array of micromechanical elements, ~~and preferably an array of  
micromirrors, and most preferably an array of pyramidal micromirrors.~~
23. (CURRENTLY AMENDED)     An The apparatus according to claim 1,  
where the modulator is reflective.

24. (CURRENTLY AMENDED)      ~~Am~~ The apparatus according to claim 1,  
where the modulator is transmissive.

25. (CURRENTLY AMENDED)      ~~Am~~ The apparatus according to claim 1,  
where the input pattern is decomposed into a number of exposure fields, and said exposure  
fields are exposed at different positions on the workpiece, thereby stitching together the  
complete pattern from said exposure fields.

26. (CURRENTLY AMENDED)      ~~Am~~ The apparatus according to claim 25,  
where the stage and projection system are adapted to making strokes of continuous travel  
relative to each other, and the electronic control system coordinates the motion, the  
loading of the modulator drive signals and the illumination, in such a way that at least two,  
~~and preferably at least ten,~~ exposure fields are exposed during an uninterrupted stroke.

27. (CURRENTLY AMENDED)      ~~Am~~ The apparatus according to claim 1,  
further comprising a timing unit controlling the timing of the emission of radiation from the  
light source.

28. (CURRENTLY AMENDED)     ~~An~~ The apparatus according to claim 27, whereby the timing unit predicts the time delay for a control signal to the light source emission according to the previous measurements, and compensates for the same.

29. (CURRENTLY AMENDED)     ~~An~~ The apparatus according to claim 1, whereby the light source is a laser, ~~and preferably an excimer laser.~~

30. (CURRENTLY AMENDED)     ~~An~~ The apparatus according to claim 1, where the illumination of at least one modulating element of the SLM is pulsed, ~~and preferably the illumination of the entire SLM.~~

31. (CURRENTLY AMENDED)     ~~An~~ The apparatus according to claim 30, where the pulse length (full width half maximum or equivalent) of the illumination of a modulating element of the SLM is shorter than the time to travel a distance corresponding to three pixels projected on the workpiece.

32. (CURRENTLY AMENDED)     ~~An~~ The apparatus according to claim 1, where the illumination of at least one modulating element of the SLM ~~is continuous~~ SLM is continuous and scanned, ~~and preferably the illumination of the entire SLM.~~



33. (CURRENTLY AMENDED)     An The apparatus according to claim 1, where the digital description of the pattern is in a symbolic format, ~~e.g. a vector or algorithmic format.~~

34. (CURRENTLY AMENDED)     An The apparatus according to claim 25, where at least one of the stage and/or the optical system is adapted to ~~producing~~ produce a microlithographic pattern with at least one of features smaller than 30  $\mu\text{m}$  and/or the placement and size accuracy better than 3  $\mu\text{m}$  (3 sigma).

35. (CURRENTLY AMENDED)     An The apparatus according to claim 1, where the pattern is formed in photoresist, photopolymer or photographic emulsion.

36. (CURRENTLY AMENDED)     An The apparatus according to claim 1, where the pattern is formed by ablation, a photorefractive effect, a photochemical alteration of a component of the workplace or by a thermal process.

37. (CURRENTLY AMENDED)     An The apparatus according to claim 1, where the electronic data processing system has an array of parallel processors for real-time pattern, conversion.

38. (NEW) The apparatus according to claim 1, where the drive signals and the modulating elements are adapted to create a number of modulation states larger than three.

39. (NEW) The apparatus according to claim 2, where the modulation impressed on the radiation field has at least four different states.

40. (NEW) The apparatus according to claim 22, wherein the micromechanical elements are micromirrors.

41. (NEW) The apparatus according to claim 40, wherein the micromirrors are pyramidal micromirrors.

42. (NEW) The apparatus according to claim 26, wherein at least ten exposure fields are exposed during an uninterrupted stroke.

43. (NEW) The apparatus according to claim 29, wherein the laser is an excimer laser.

44. (NEW) The apparatus according to claim 30, wherein the illumination of the entire SLM is pulsed.

45. (NEW) The apparatus according to claim 32, wherein the illumination of the entire SLM is continuous and scanned.

46. (NEW) The apparatus according to claim 7, wherein said response is the light absorption of a developed silver halide emulsion, or the removal of material mass per surface area by an ablation process.

47. (NEW) The apparatus according to claim 11, wherein there are four binary signals creating sixteen different states of the modulating element.

48. (NEW) The apparatus according to claim 33, wherein the symbolic format is a vector or algorithmic format.

49. (NEW) The apparatus according to claim 1, wherein the workpiece sensitive to light radiation is a photomask, a display panel or a microoptical device.